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## POLYMORPHISM IN *SUNIRA BICOLORAGO* (NOCTUIDAE)

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*Sunira bicolorago* is NORMALLY the commonest autumn Noctuid in the northeastern United States. In peak years it fairly swarms at light, even in metropolitan areas. In the course of handling large numbers of this species attracted to light in Pennsylvania in the autumn of 1961, the author's attention was called to its variability. Breeding experiments were initiated which, combined with continued sampling, have provided some preliminary information on the nature of the polymorphism observed.

The normal form at Philadelphia is nymotypical *bicolorago*, characterized by a rather uniform orange-buff coloration, varying to straw and orange ochre, but without marked contrasts. The hind wing may be unmarked straw or more or less heavily infuscated with gray, often with a poorly-defined postmedial line and a dark but vague terminal shade, sometimes with traces of a discal dot. The medial shade of the fore wing ranges from hardly distinguishable to strongly contrasting, as do the dark shades on either side of, and defining, the subterminal line. All of the markings on the fore wing vary greatly in strength. The lightest *bicolorago* of both sexes, with straw hind wing and light buff fore wing with no strong markings, have been called *de-cipiens* Grt. In long series it may be seen that they intergrade completely, and the usefulness of the name is questionable.

The form *ferrugineoides* Gn. has the outer half of the fore wing contrasting, solidly gray or gray-black (rarely shining black), the markings obscured basad to the medial shade. The hind wing is heavily shaded with gray from the postmedial outward, basad variable but always decidedly lighter, corresponding

to the effect on the fore wing. This hind wing pattern is constant, unlike the typical form which is variable, but never shows this pattern.

The form *ferrugineoides* is rare in southeastern Pennsylvania, constituting slightly over one per cent. of the 7000-plus specimens I have examined since 1961. Its frequency has not varied significantly over this period, although the population expanded greatly in 1963 and remained at above-normal levels in 1964.

Fully developed *ferrugineoides* has not been seen from Philadelphia and the surrounding counties, though it does occur at least as far east as Dauphin County. Philadelphia-area specimens show the contrasting outer half a greasy-looking fuscous, thin enough that the gray spot in the lower part of the reiform, and often the subterminal line, can be detected with little difficulty; rarely all the markings are traceable. Such specimens are found with the fully darkened *ferrugineoides* where the form is commoner, as in western Pennsylvania and much of New York and New England.

These facts suggest that the light *ferrugineoides* from Philadelphia and elsewhere are heterozygotes, and that the form is controlled in a simple way genetically. With so low a heterozygote frequency, the lack of homozygotes would hardly be disturbing (assuming the Hardy-Weinberg law applies). This hypothesis has been confirmed by breeding.

A female *ferrugineoides* already mated to a wild male of unknown phenotype was obtained at light in 1961 and confined. 78 ova were obtained. The eggs were placed outdoors and the larvae sleeved on maple (*Acer saccharium*) the following spring. A total of 24 adults emerged in early August, several weeks before most wild individuals were flying. There were 11 *ferrugineoides* in the lot. Two sib matings within the typical part of this brood were obtained, with three within *ferrugineoides* and a cross of male *decipiens* x female *ferrugineoides*. They were treated in the same manner and gave adults in August-September, 1963. The results are shown in Table I, from which it may be seen that fully dark *ferrugineoides*, not seen wild locally, were produced and thus demonstrated the potential occurrence of that form locally. The graduation from darkest to lightest is continuous, the paler homozygotes and darker heterozygotes probably overlapping. One mating of two dark specimens was obtained, as well as one of a dark x light *ferrugineoides*. The resultant generation appeared in August, 1964 and is also given in Table I.

TABLE I

Genetic data on forms of *Sunira bicolorago* Gn.f. = *ferrugineoides*; b = *bicolorago*.

Mating	Expected Ratio	Brood Ratio	$\chi^2$	P
1. ? x f. ♀ wild	1:1	11:13	0.666	.40 < P < .60
2. b. ♂ (1) x b. ♀ (1)	0:1	0:29	—	—
3. b. ♂ (1) x b. ♀ (1)	0:1	0:36	—	—
4. b. ♂ (1) x f. ♀ (1)	1:1	23:28	0.490	.30 < P < .50
5. f. ♂ (1) x f. ♀ (1)	3:1	20:6 <sub>1</sub>	0.051	.80 < P < .90
6. f. ♂ (1) x f. ♀ (1)	3:1	25:9 <sub>1</sub>	0.039	.80 < P < .90
7. f. ♂ (6) <sub>2</sub> x f. ♀ (6) <sub>2</sub>	1:0	35:0 <sub>1</sub>	—	—
8. f. ♂ (5) <sub>2</sub> x f. ♀ (6)	1:0	12:0 <sub>1</sub>	—	—
9. b. ♂ (3) x f. ♀ (5) <sub>2</sub>	1:0	27:0	—	—
10. b. ♂ (3) x f. ♀ (6)	1:0 <sub>3</sub>	56:0	—	—

<sub>1</sub> Includes fully dark individuals.<sub>2</sub> Fully dark individual (homozygote).<sub>3</sub> The female was apparently a light homozygote.

The hypothesis of a partially dominant "*ferrugineoides*" allele has thus been confirmed. At the same time, minor variation in the strength of the medial shade and subterminal shading in *bicolorago* was found to be continuous; no attempt was made to determine whether this variation was genetic or (as seems likely) at least partly environmental.

In the course of collecting a third, and radically different, ground-color form was found. No similar specimens could be located in the extensive series of the United States National Museum and American Entomological Society collections. This form is strikingly different in general facies from any other type of *bicolorago*. A description follows.

### ***Sunira bicolorago* form *brunnea*, f. nov.**

MALE. Ground-color reddish brown with a slight purplish tinge, about the color of *Crocigrapha normani*, the usual markings present and with the normal amount and type of variability in same, the dark pattern in heavy fuscous, with the light lines more or less contrasting, pale brown. Fringe fuscous, the usual light points at the veins preserved. Upper surface of secondaries variably dark gray with more or less of the postmedial line, as in the typical form, but darker; fringes mainly fuscous, paler than

on primaries. Under surface brownish pale fuscous with usually well-developed discal dot and postmedial line on all wings. Head, thorax, legs and antennae with usual orange, ochre or buff coloration replaced by reddish brown throughout; abdomen gray, lighter beneath, concolorous with the wings on both surfaces, the genitalic tufts ochre brown. Genitalia as in the other forms. Size variable, as in the other forms, generally ca. 26 mm.

FEMALE Not seen.

Types: Holotype male, Erdenheim, Montgomery Co., Pa., IX.26.64; paratypes: Conshohocken, Montgomery Co., Pa., X.3.64; Mt. Airy, Philadelphia Co., Pa., X.7.61; Wissahickon, Philadelphia Co., Pa., IX.28.63; Devon, Chester Co., Pa., X.4.63. Type to be deposited in the Academy of Natural Sciences, Philadelphia; paratypes presently retained by the author.

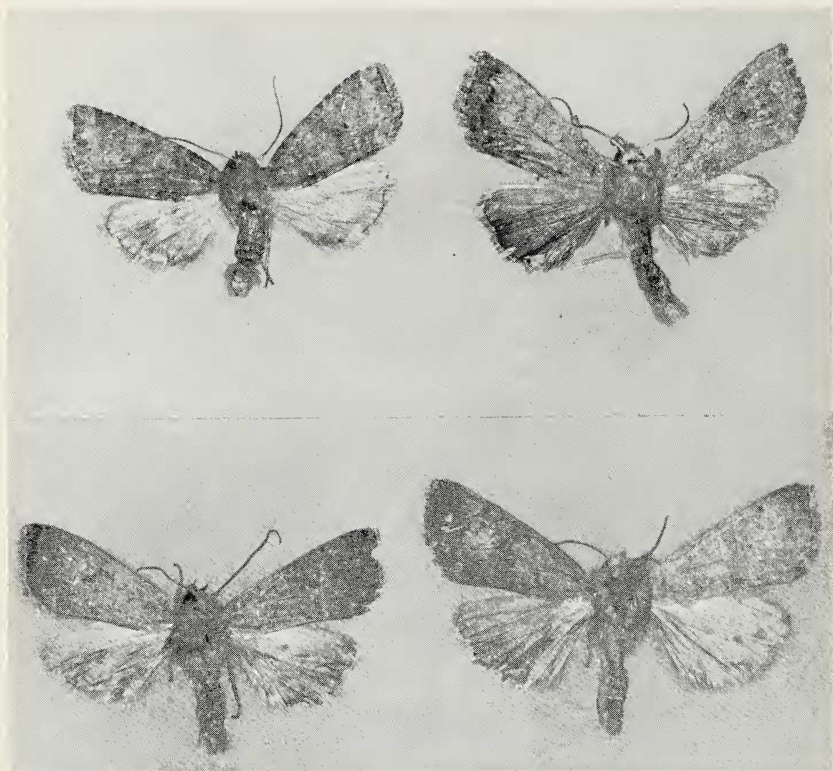


Fig. 1. Above: left: *Anathix puta* ♂. right: *S. bicolorago*, f. nov. *brunnea*. Below, typical *S. bicolorago*. Montgomery Co., Pa.

This form is easily separated from the others of its species, but is apt to be confused with a number of superficially similar Noctuids. It apparently can occur with the full range of variation within the usual types, the only difference being the brown color which, however, imparts to the insect a very distinct appearance. It is almost certainly genetic. If we assume it to be recessive, its frequency at Philadelphia and vicinity is between one and two per cent. Similar specimens almost certainly exist in various collections, unrecognized or confused with other species. There is a marked superficial similarity to *Anathix puta* G.&R., from which the form may be told quickly by the differently shaped postmedial, the less uniform brown color, and the lack of black points on the subterminal.

The *brunnea* form has not been seen in combination with *ferrugineoides*. This fact is hardly surprising, considering that *brunnea* almost certainly has a frequency or less than 2% in Pennsylvania, and *ferrugineoides* is as rare as it is. It is likely, however, that such a genotype can and does occur; the moth produced would probably be a most striking form, with brown basal and gray-black apical half of the fore wing, and a dark, two-toned hind wing. No intergrades, or anything approaching an intergrade, to the typical or other known forms, have been seen. The new form is separated from the darkest red specimens of other forms by a marked discontinuity. It clearly is not the extreme in a continuous variation.

At least the *ferrugineoides* form (and probably *brunnea*) of *S. bicolorago* represents an instance of dimorphism where relative frequencies of the various types vary with locality, reflecting differing selective pressures and adaptive values. More data on the relative frequencies of the forms in this widespread, abundant, and easily sampled species would be of considerable interest and value.